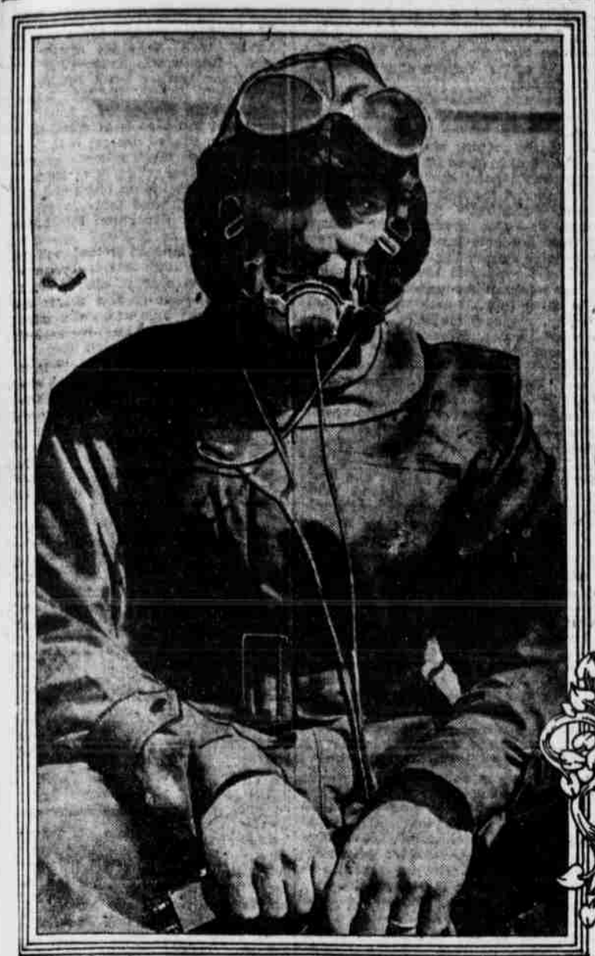
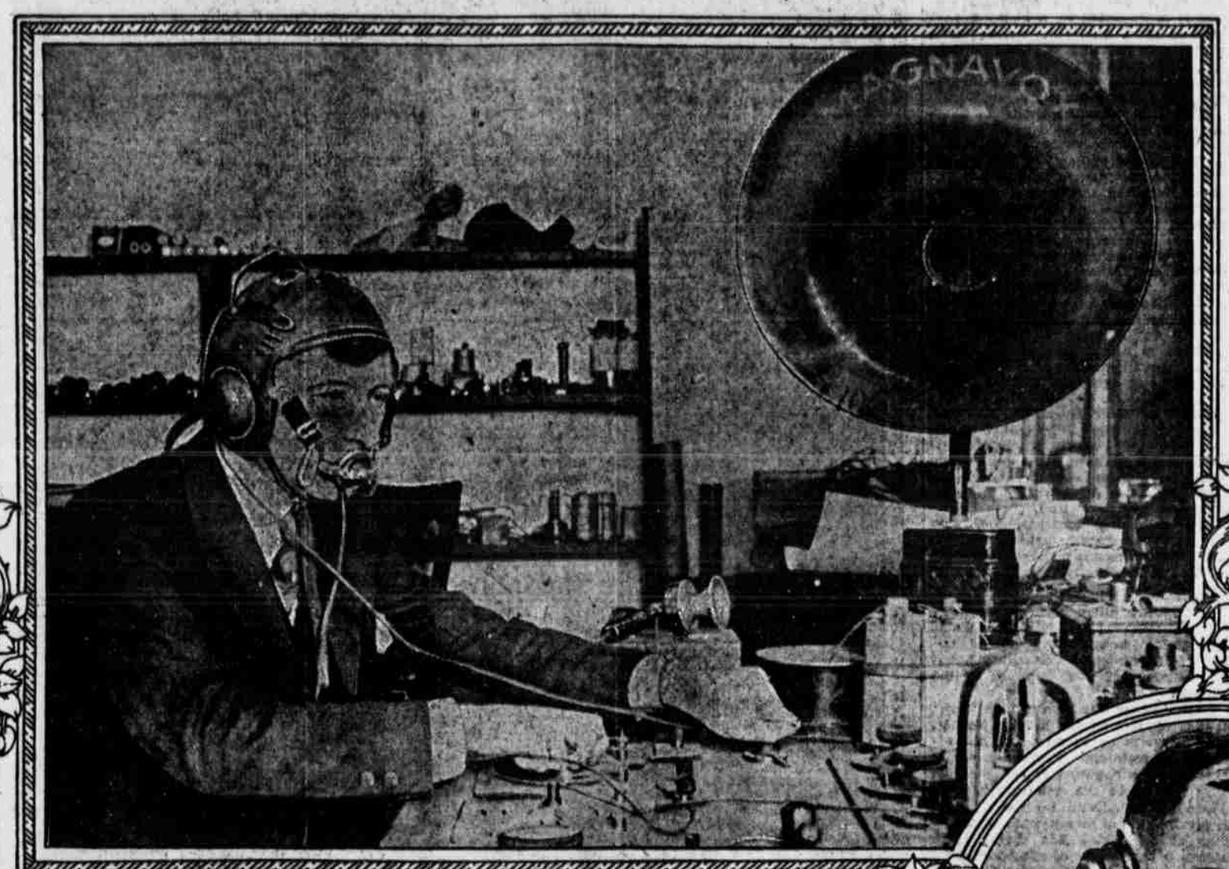
This New Telephone Filters Out All Troublesome Noises

Even if a Rivet Gun Is Roaring Outside Your Window the Other Man Will Hear Only Your Voice—Pridham-Jensen Invention Made Possible Wireless Phoning From Uncle Sam's Airplanes Over Battle Lines

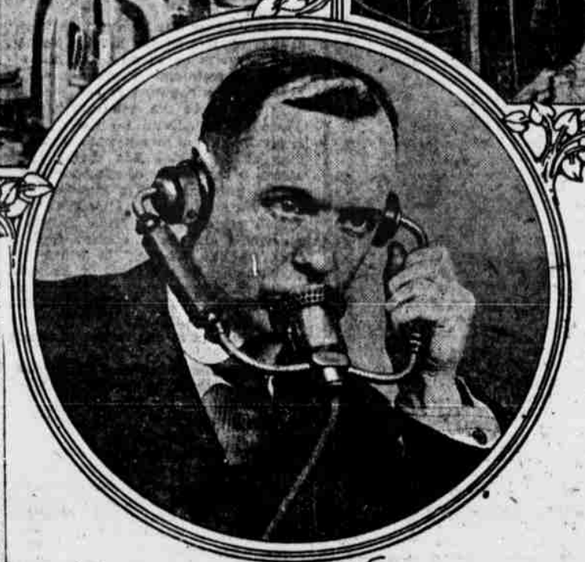


THE ANTI-NOISE AIRPLANE TELEPHONE SET.



PETER L. JENSEN, ONE OF THE INVENTORS IN HIS LABORATORY.

FRITZI SCHEFF, SINGING TO 50,000 PEOPLE IN GRANT PARK, CHICAGO, DURING THE VICTORY LOAN DEMONSTRATION THERE.



E. S. PRIDHAM, ONE OF THE INVENTORS, DEMONSTRATING THE ANTI-NOISE TRANSMITTER.

"FOR goodness sake be quiet! How can any one hear if you keep up your chatter! This isn't a megaphone—it's a telephone!"

Most of us can recall times by the score when we have chided some one in similar fashion. Strain our ears as we might it was next to impossible to shut out nearby conversation and to make out the muffled speech of the talker at the other end of a telephone circuit. Again, even if no one near by caused a vexatious disturbance, still a cold in the head or permanent deafness even of a moderate degree would suffice to render it difficult to understand the far off speaker. The distant transmitter could not convey the voice waves with sufficient clearness.

On the other hand, the speech coming over the wire has often been so mixed with a jumble of other sounds that it was quite out of the question to get the message. This was because the sensive transmitter operated without discrimination—it picked up impartially any sound wave and sent it along in the form of electrical impulses, which the receiver translated accordingly. We have stormed at central and blamed her for giving us a bad connection, when in fact the whole trouble lay in the exquisite responsiveness of the microphone transmitter and the minute vibrations of granules of carbon purposely placed in the circuit to catch and to forward the faintest of sound waves.

Upon other occasions we have been nettled because the arriving speech was so "dampened" that the ear could understand only a word now and then. It was as if the person at the other end of the line were talking through an interposed blanket. The fault was not with the telephonic apparatus, but due entirely to the fact that the remote speaker was not blessed with a "carrying voice." No matter whether he or she spoke loudly or in an ordinary conversational tone the indistinctness persisted. The difficulty was further amplified at the receiving end by the least noise, which commonly would have passed unheeded. Thank goodness, these handicaps to telephone converse are things of the past; at least they can be made so by recourse to certain recent inventions which our participation in the world war hastened to perfection.

Evolution of the Instrument.

To appreciate these revolutionary developments in telephony (they apply equally to radio as well as to wire communication) we might just as well start at the beginning of the story. A good many people have given of their time and of their engineering and imaginative cunning in seeking to improve voice transmission over the everyday telephone systems of the country. Both the receiver and the transmitter have been studied, modified, sensitized, and withal modelled so that they would be effective and likewise strong. Simplification has been necessary in order to meet the commercial requirements of durability and moderate cost of upkeep; in short, the apparatus had to be reliable no matter by whom handled in common use.

As a consequence, splendid results have been secured so far as the instruments themselves are concerned. But, even so, all of us know that it is next to impossible to talk satisfactorily by 'phone in a public station or any other bustling place unless one can retreat to the privacy of a booth so fashioned that most external noises are held at bay. The telephone engineer has striven in various ways to shut out interfering sounds, and this has been the accepted line of endeavor for years. No one is likely to wax enthusiastic over the telephone booth in warm weather, particularly if the talk goes on for a number of minutes. Copious perspiration does not make for contentment; but the booth has come to be accepted as a sort of necessary evil, and the loudest faultfinder will grudgingly admit that he does not see how he could get along without it at times.

But the heartening news for all of us is the undeniable fact that these seemingly indispensable torture chambers are no longer necessary—the anti-noise telephone has made them obsolete. Now for the tale of a war time device—kept secret for many months by order of the Government—which is available to-day for public service for the promotion of vocal intercourse under circumstances hitherto well nigh prohibitive. We owe this amazing departure to the originality of two men who had the inspiration to break away from the conventional lines of research and to blaze an entirely new path in an opposite direction, so to speak.

When the United States Government decided to establish a high power radiotelegraph station at the navy yard, Mare Island, California, the system adopted was that developed by Waldemar Poulsen, the Danish inventor of the well known flaming arc transmitter. Dr. Poulsen sent to the United States at that time a youthful representative, Peter L. Jensen, who had been associated with him in his wireless researches. Subsequently Mr. Jensen met Edwin S. Pridham, a Californian and a Stanford University alumnus, who was also an electrical engineer. Together these men worked in putting up and in operating the first American station to use the Poulsen method. That comradeship led them to collaborate in efforts to improve both wireless and telephone apparatus. Finally, believing that much could be learned by a trip abroad, Pridham and Jensen went to Europe in the latter part of 1910, where they met and discussed various problems in radiotelegraphy with foreign pioneers in the art.

A Loud Speaker Produced.

While there they discovered traces of research which they believed would be well worth following; and in 1911 they returned to California full of this idea, but with purses too much depleted to enable them to go very far in purchasing the needful apparatus. However, they happily interested a local retired capitalist, Richard O'Connor, who furnished funds enough to equip an experimental laboratory at Napa, a little north of San Pablo Bay. It was there that they hit upon a radically different type of telephone receiver, which led a short time afterward to the production of a conspicuously loud speaking instrument.

In the ordinary telephone the receiver consists of a thin, soft, iron diaphragm, which is vibrated or flexed by the arriving electrical impulses sent over the circuit to a magnet lying just back of the disk. The movement of the disk, responding to the electrical waves induced at the distant end of the line by the transmitter, produces sound waves which the listener's ear recognizes as speech. Pridham and Jensen broke away from this form of receiver and developed instead one which is technically characterized as "the saturated field, electro-dynamic type," in which a flat coil of wire is so placed that it will vibrate across the path of the operating lines of magnetic force much after the manner of a hair spring, let us say, in the sweep on an electric fan's breath.

This coil is attached to a bronze, not an iron, diaphragm, and the latter is so affected that it reproduces with peculiar clearness and faithfulness every impulse set up by the far away transmitter. Without going into technical niceties the consequence of this invention is an amplification of the transmitted sound and thus came into being the Magnavox, or loud speaking telephone. This is only one phase of the problem, however.

While the loud speaking telephone by itself makes it possible for the listener to hear when it might otherwise be very difficult or out of the question for him to do so, still a 'phone conversation is not a one sided affair, as all of us know. The loud speaking receiver is good enough as far as it goes, but the very noises which it overcomes locally must be kept out of the transmitter when the listener starts to talk. For example, let us imagine that the telephone connection is between some on in the peaceful atmosphere of the suburbs and a man in Manhattan whose office is next door to a skyscraper in the process of erection. The rivet gun is creating a deafening din, but even so, the loud speaking receiver neutralizes this sufficiently to permit the man near by to hear his friend at the other end of the line.

Now if there were no way of effectually shutting out from the transmitter the racket of the pneumatic hammer, the man in Manhattan, no matter how he shouted, would probably not be able to send intelligible speech to the listener in the far off quiet; the latter would get both the speech waves and the noise waves.

How the Problem Was Solved.

How did the inventors perfect their anti-noise transmitter two years ago? If they didn't do as other telephone engineers have done—try to shut out extraneous sounds—then by what method did they reach the much desired goal of seeming silence amid confusion?

Startling as it may appear, they actually achieved their end by letting the racket have free access to the diaphragm of the transmitter! But they introduced a radical innovation; they allowed the unwelcome noises to reach at the same time both sides of the disk. They purposely put this metallic membrane where it could be easily approached by these sound waves. All of this has the earmarks of contradiction, but it was really cunningly devised engineering jiu-jitsu—the strength of disturbing sounds was turned against itself so that feebler forces could prevail.

In the transmitter commonly employed by telephone systems, the diaphragm is so placed that the voice or sound waves impinge upon only one side of it—the outer surface. And the disk is flexed in and out agreeably to the vigor of the attacking impulses. In a sense, we have an analogy in a swinging door blocking a passage in which traffic is in a single direction. The door sways back in position after each person has pushed the way clear and gone forward. But suppose the human tide is not in one direction, and two men of equal strength reach the door simultaneously on opposite sides? Their opposing efforts are neutralized and the door lies between them unmoved. This is exactly what occurs when noise waves are admitted at the same time to the two surfaces of the diaphragm of the Pridham-Jensen transmitter. The disk remains immobile.

To carry our analogy a little further, we introduce a hastening messenger boy, who impatiently adds his weaker efforts to those of one of the men. This accession of energy destroys the balance and the door swings in response to the amplified thrust, but only agreeably to the strength of the lad. In exactly the same way do the voice waves vibrate the transmitting disk, which otherwise is motionless no matter what the volume of noise waves reaching it from both sides. The voice waves of course impinge only on one face fo the diaphragm—i. e., the one nearer the mouth of the speaker. The principles involved are so extremely simple that it is a wonder that no one else thought of applying them earlier, but the fact that such was not done until Pridham and Jensen came along is only one more proof of how the technical mind is prone to follow in a groove and to deepen this rather than to turn abruptly into fresh territory.

At the very start, once the anti-noise and loud speaking telephone was developed, naval and military officials here and among our allies abroad were quick to sense its value in aviation. Previously conversation between the pilot and the observer in a scouting machine was practically out of the question—they had to communicate for the most part either by signs or by writing, and this hampered to a serious extent their teamwork and their effectiveness aloft. The speeding airplane, even to one listening from the ground, sounds at a distance like a great bumblebee, and when closer the noise is not unlike that of a bristling planing mill. Imagine, then, the situation of the men right next to the whirring propellers and the thunderous roar of the exhausting motors! Speech between them is impossible by word of mouth, as the term is usually understood. To all intent and purpose they are stone deaf.

Airmen Used It in War.

We know that American genius gave us a wireless telephone capable of considerable range, which played no inconspicuous part on the battle front in France, where our hidden batteries were brought to bear with telling effect upon the Germans. Not only were the men aloft able to transmit vitally helpful information to the battery commanders below, but they could receive vocal directions themselves. Further, when our flying machines operated in groups it was practicable for the flight commander thus to communicate with the rest of the squadron. Logically, this intercourse would have been impossible but for the loud speaking, anti-noise telephone equipments placed aboard our planes. Likewise, so it is said, both the French and the British air services made use of this apparatus.

No wonder, then, that German airmen were instructed, as were also the Teuton anti-aircraft batteries, to do their utmost to drive to earth behind the German lines hostile flying machines provided with the American type of telephone. The Kaiser's General Staff was keen to have captured one of these outfits. While the Germans had developed a wireless telephone for aircraft, the instruments were by no means satisfactory and could be used only under the most favorable circumstances. What applies in the case of the two seater is also true, but upon a wider scale, where the plane carries a larger number of persons. The employment of the anti-noise, loud speaking telephone is absolutely indispensable for coordinated action among the various men at the stations of control.

Had the Pridham-Jensen inventions not been available in equipping the transatlantic NC seaplanes it is doubtful whether or not they would have succeeded in accomplishing what they did in the initial hop from Newfoundland to the Azores. Think of it—each one of those great aircraft carried four powerful Liberty motors, and when their screws were churning the atmosphere at full speed and each cylinder was exhausting with the noise of a good sized gun, the din was several times worse than that of a big boiler shop! Even so, the navigator, the pilot, the engineer, the radio man and other members of the crew were in vocal contact every moment of those strenuous hours aloft. Not only that, but the radio operator could talk with the companion seaplanes if within a radius of twenty-five miles, or with the destroyers which buoyed the route along the many hundreds of miles of ocean waste. Further, the faint signals of the wireless telegraph, coming from still farther away, could be picked up audibly!

For airplane service there was developed a special headgear attachment which kept the double receivers pressed snugly over the ears and held the transmitter at the desired point in front of the wearer's mouth, be he pilot, passenger or another member of the personnel. An interesting example of the value of this outfit was given during the time when we had reason to fear the activities of U-boats in domestic waters. Henry P. Davison, Jr., of New York city was piloting a plane high in the air off the Virginia Capes, scouting for enemy submarines. His mechanician by chance happened to see a drain cock drop away from the flying machine's radiator, and promptly telephoned Davison of the impending peril. The latter immediately started to volplane to the sea's surface, where he successfully alighted with his motor jammed and pretty nearly red hot.

A Boon to Seafaring Men.

As a consequence of its war time service, the Pridham-Jensen telephone is now being installed extensively aboard the craft of our fighting fleet and on the vessels of the United States Shipping Board, so that the man on the bridge and those scattered below in noisy places can be reached instantly and perfectly by word of mouth. Pounding engines, rattling machinery of all sorts, and the thunder of whole broadsides have no effect on the anti-noise transmitter, while the sound proof, loud speaking, double receivers complete the cycle of a perfect telephone service. This has been quite unattainable heretofore; on shipboard messages between the bridge and the engine room have commonly been exchanged by a mechanical device, the ship's telegraph, which carries its orders visually, and only a few of these.

It takes no stretch of the imagination to conceive places where apparatus of this kind would fill a long felt want. For instance, in a boiler factory, a planing mill, a noisy machine shop, a pressroom, or in the neighborhood of the rumble and roar of a busy thoroughfare. Again, there are some of us who have not perfect hearing, and, by aid of the double receivers and the conveniently placed transmitter, this handicap can be to a great extent neutralized. It requires only one hand to hold the apparatus in position when designed for use on shipboard or anywhere in an office, in a factory, or in the general run of settings familiar to all of us.

Another field of employment, made possible by O. B. Moorehead of San Francisco, is where the loud speaking receiver is linked up with audions, which amplify the volume of sound and spread it broadcast either in a hall or out in the open through the agency of suitable megaphones. In this way, wireless telephone messages despatched earthward from thousands of feet in the air have been made audible to immense crowds, or one speaker or singer, without taxing the voice, has been able to reach and to sway a multitude. Any person, with even modest vision, can conjure up a score or more of circumstances in which apparatus of this character would render unique and splendid service. Similarly, all of us can picture some of the wonderful things that the Pridham-Jensen telephone will render possible. It will be infinitely easier, hereafter, to get better results over "long distance." We may be thankful that the war has given this equipment which will prove of the greatest service in the busy, happy, fruitful period of peace.

Famous Fighting Bulls of Spain

THE famous fighting bulls of Spain are among the interests of the Andalusian plains. The Spanish bull often has a rather hollow back; its horns are large, rather wide, and turned up and inward—never short, very thick and turned downward, as is usually the case with bulls of other countries.

In its early youth the Spanish bull roams in comparative freedom over the plain. It early makes acquaintance, however, with the garrochista's pic. Though the latter is merely a pole with no blade, but only a small point, like the shod end of an alpenstock, it is a formidable weapon when cleverly wielded.

At the age of about two and a half a crisis arrives in the life of a fighting bull. The ordeal, which every animal must undergo, is one that very few foreigners have witnessed.

In the cool of the late afternoon a party of horsemen gather on a plain, accompanied by a professional picador. Two of the number, armed with long lances, ride up to the herd, round which is a guardian ring of horsemen. It should be mentioned that the full herd has already been split into two portions by the removal of the belled bullocks to a distance of half a mile. The guards now allow a bull to escape and off the latter goes at once toward his bullock friends, tail in air, scurrying over the plain, closely pursued by the galloping horsemen.

The latter, indifferently mounted on ewe necked ponies, do not usually succeed in overhauling their quarry for a few hundred yards; but then the nearest horseman, with his lance in rest, ranges alongside and delivers a prod. The bull turns to one side, letting up the other horseman, who in his turn delivers a thrust and throws the bull over.

Up gets the bull and again flees, pursued as before by the horsemen. The whole business is very like pigsticking, with a much larger and slower quarry. This time the animal makes toward the other horsemen, who in scattered groups are for the present spectators and possibly judges of the sport.

Before the bull reaches the latter, however, one of his pursuers ranges alongside once more, when the bull receives a third prod and down he goes again. Thoroughly annoyed, he swings round for the charge, but his immediate adversary has galloped on and is out of reach. He turns his attention, therefore, to number two, whose place has now been taken by the professional picador. This man, with couched lance, awaits the bull's onset. The latter charges again and yet again, to be received each time on the point of the lance.

And so the game proceeds. If the bull after receiving a plentiful succession of jabs, which merely inflict flesh wounds and do no serious harm, is undismayed and continues to charge as gamely as ever, he is considered to have pluck and fire enough to be worthy of the ring. But should he, finding that his charges are fruitless, turn sulky, refuse to charge his opponents and endeavor to flee from them, he is branded as cowardly, is fattened, and in due time is converted into beef.

The toreador has not always been the hero of the bull ring. There was once a bull that earned the plaudits of a Spanish arena on more than one occasion by clearing it of his antagonists. Strangely enough the bull neither killed nor injured any man. But he did put to flight every toreador, matador, picador, chulo or banderillero who dared to enter the ring with him; and, although the crowds came to see him slain, his conduct proved so valiant that the people demanded that his life be spared.

This bull was named Lechuzo. His first appearance in the arena was made at San Lucar. He so suddenly cleared the ring of his enemies that the people rose in admiration and demanded his reprieve, for despite his bravery he would have been treacherously approached and put to death in accordance with the usual practice had not the people intervened.

Again at Cordoba upon the healing of the wounds inflicted upon him by the picadors at San Lucar Lechuzo drove all his enemies before him and again his life was spared at the demand of the spectators.

So in time Lechuzo began to be regarded as invincible, and finally he ended his days in peace at the age of ten years. Some admirers were desirous of testifying to his prowess by erecting at San Lucar a monument in his honor, but nothing came of the proposal.

Some years ago a herd of Texas bulls were imported from their native land to Seville to give special attraction to a bullfight of more than ordinary importance. Those American bulls furnished the Spaniards with some interesting sport.

The first of the intended victims when confronted in the ring by horse and picador wholly neglected the horse, but paid instant and undivided attention to the man. The bull bellowed as if from sheer delight at the anticipated encounter and attacked the picador furiously. He pressed the fighter so hard that, defence being useless, the man sought safety in inglorious flight by scaling the barrier erected between the audience and the ring as a provision of safety.

The picador was ardently and efficiently assisted over the barrier by the horns of the steer and was followed so closely that he narrowly escaped with his life by reaching a convenient gallery. The steer did his best to get at him, but, finding this impossible, looked about for other game.

The stone seats in the enclosure at Seville were ten feet above the ground, and this height has always been an insurmountable barrier for a bull, but this time things were different, for as soon as the Texan bull saw the throng above his head he stepped back, and the next instant he was among them.

Before the people could escape he had tossed half a dozen of them into the ring, but they were all rescued by the ring attendants. The stone seats cleared, the steer returned to the ring, and seeing no one else to whom he might throw the gage of battle, he took the exact centre of the ring and bellowed his defiance to the world. Meantime the management had got busy, and a soldier with a Mauser was summoned from a nearby barracks and the bull's life was ingloriously ended.

The Grandeur of Gibraltar

VIEWED from the deck of an ocean liner surging through the waves of the Mediterranean one can never forget the thrill he experiences at first sight of Gibraltar. Spanish girls of rare beauty come out in small boats to greet you, and when by the aid of a rope they hoist grapes up along the side of the ship it is seldom their baskets are lowered without a goodly amount of money in exchange for the fruit. Sounds of drums and bugles add to the exciting din, and amidst screeching whistles you descend to one of the tenders which wait below to take you ashore.

The little Spanish stuccoed houses are to be seen everywhere, and the women and girls with shawls of brilliant hues and mantillas upon their heads laugh and dance to the twang of a guitar.

Driving through the narrow cobbled streets, visitors are constantly stopped by the natives, who attempt to sell them all sorts of trinkets, for jewelry shops appear at almost every corner. Eating places of every variety, with food at reaching distance from the curb, occupy the tiny sidewalks, and little children crawl in front of the phaeton like cabs with the hope of collecting a few pennies.

Finally the Alameda is reached, and this park, with its palm and cactus plants, is the pride of Gibraltar. Geraniums in abundance crown the entrance and tropical trees and bowers help to create a scene well to be remembered. Fountains play about on the east and west sides, while several small boulevards twine in and out through the park. Attractive pony carts carrying little rosy faced English children accompanied by their Spanish servants, occupy the roseate driveways in the Alameda, and the liquid songs of the birds give a touch of softness and pathos to the spot.

And now we come to the scorpion rock of Gibraltar which cannot be appreciated from the water front, for the town stretches along the western side for over a mile, and only when directly in the interior of the colony can the gigantic size of the rock rightfully be estimated. It stands as if against the sky with a prepossessing dignity of indescribable mightiness and power. Tarik, the one eyed Moor, landed at the foot of the rock of Calpe (now known as Gibraltar) in the year 711 to reconnoitre Gothic Spain, and therefore from Gibel Tarik (which means the hill of Tarik) the name of Gibraltar originated.

Low wheeled, two seated, so-called vans accompanied and drawn by ponies take the visitor to the base of the fortress, and a steep climb must then be made on foot. It is an extremely tedious trip, for the ascent is rocky and uneven

Perhaps the most striking view, from a small opening in one of the caves built in the fortress is the white wall of Algeciras and San Roque, both paralled with the snow capped mountains of Andalusia.

El Hacho, the signal tower, is not always open to visitors and many of the heavy guns are also kept under secrecy. In the tunnelled portions of the fort old batteries and cannon are pointed out by sentries, and secluded spots had been set aside for punishing purposes in bygone years. In one of the dark passageways the stone is cut in peculiar points which stand straight upward, representing icicles because of the shiny, silvery gloss on the ends of the highest needles of the rock, and one can readily imagine fireplaces to have been inserted in the walls.

Having attained the height of the fort and emerging suddenly into open sky, a wonderful vista stretches out 1,000 feet below. Ships anchored at bay seem but dwarfs, and the polo grounds, once famous for bull fighting, can also be observed. Far below the barrack yards look up at you and the smoky houses with their sloping roofs keep cover over the lounging soldiers.

As the sun takes refuge behind the fleecy lining of clouds, the mountains, hills and ocean form a panorama of wide scope and incomparable beauty.